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Mark Scheme (Results)

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Pearson BTEC Nationals
In Applied Science (31629H)
Unit 7: Contemporary Issues In Science

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Unit 7: Contemporary Issues in Science - Sample marking grid

General Marking Guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Marking grids should be applied positively. Learners must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the marking grid not according to their perception of where the grade boundaries may lie.
- All marks on the marking grid should be used appropriately.
- All the marks on the marking grid are designed to be awarded. Examiners should always award full marks if deserved. Examiners should also be prepared to award zero marks if the learner's response is not rewardable according to the marking grid.
- Where judgment is required, a marking grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the marking grid to a learner's response, a senior examiner should be consulted.

Specific Marking guidance

The marking grids have been designed to assess learner work holistically.

Rows within the grids identify the assessment focus/outcome being targeted. When using a marking grid, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band depending on how they have evidenced each of the descriptor bullet points.

Question 1: *Discuss the implications of the scientific issue identified in the articles. (12 marks)*

Assessment focus	Band 0	Band 1	Band 2	Band 3	Band 4
	0	1-3	4-6	7-9	10-12
Understanding the impact in terms of ethical/ social/ economical/ environmental	Level of response not worthy of credit	• Demonstrates limited knowledge and understanding of the scientific issues with generalised comments made. • No or limited attempt to draw links to ethical/social/ economic/ environmental implications. • The discussion will be unstructured and limited to basic points made.	• Demonstrates adequate knowledge and understanding of the scientific issues by identifying and selecting relevant implications from all three articles. • Attempts to draw links to ethical/social/ economic/ environmental implications. • The discussion shows some structure and coherence.	• Demonstrates good knowledge and understanding of the scientific issues by identifying and selecting relevant implications from all three articles. • Draws some links to and between ethical/social/ economic/ environmental implications. • The discussion shows a structure which is mostly clear, coherent and logical.	• Demonstrates comprehensive knowledge and understanding of the scientific issues by identifying and selecting relevant implications from all three articles. • Draws a wide range of links to and between ethical/social/ economic/ environmental implications • The discussion shows a well-developed structure which is clear, coherent and logical.

Possible indicative content for Question 1:

Learners:

- **may include other valid suggestions, not listed below, which should be credited**
- **may cover a number of examples from the list below**
- **would <u>not</u> be expected to cover all points to get full marks.**

Scientific issue:

- Stem cells may be used to treat many degenerative and autoimmune diseases, which affect many in modern day societies (diseases of chronicity).
- Such as heart disease (the leading cause of death worldwide), stroke, Parkinson's, Alzheimer's, macular degeneration, leukaemia, thalassaemia, diabetes, spinal muscular atrophy, spinal cord injuries, multiple sclerosis (MS), dental pulpitis and epidermolysis bullosa (EB), male pattern baldness
- May also be able to treat some types of cancer
- However transplanted stem cells have the potential to develop into tumours
- Transplanted tissue could be rejected
- But using patient's own stem cells will not lead to rejection
- Stem cells also provide a source of human cells for research for studying diseases and testing drugs for specific conditions
- First use of stem cells was bone marrow transplant in 1939. Bone marrow transplants were improved after 1970 due to improved understanding of immunology and genetics and donor matching
- 1997 saw the cloning of Dolly the Sheep (from the fusion of an enucleated egg and a mammary gland cell) and the beginnings of regenerative medicine
- Totipotent (able to differentiate into any type of cell) embryonic stem cells (ESCs) were obtained from embryos (spare embryos from IVF treatments, with approval from Human Fertilisation and Embryology Authority) but raises ethical concerns
- 2006, Shinya Yamanaka reprogrammed adult differentiated cells to become induced pluripotent stem cells (iPSCs). He added four transcription factors that switch back on genes that were switched off during differentiation. He shared the Nobel Prize for this in 2012

- These cells are nearly as potent as ESCs and do not raise ethical objections about their source
- But there is a concern that whole humans may be cloned –although in most countries that is strictly illegal
- They can be obtained from the patient which removes the risk of rejection but in some cases, e.g. where patient has genetic defect/faulty allele for dominant condition, donor cells are better
- Since then much research and many clinical trials (increasing at an exponential rate) to use iPSCs to treat a range of diseases as listed above
- The market is growing and large companies and venture capitalists are investing in this sector
- Stem cells may also be used to test new drugs or may be able to reduce the need for/make up the shortfall in organ donors and reduce the illegal trade in organs/reduce numbers of animals used for research and testing
- Stem cells can be maintained in lab for long periods and large numbers of cells produced
- Still many challenges to be addressed and regulatory guidelines and standards to be set. Scientific, ethical, safety (can stem cells become cancerous and could iPSCs be used to clone humans?) and legal issues to be addressed. There are unregulated unscrupulous clinics offering untested stem cell therapies
- In the near future stem cell therapy could significantly improve human health.

Comment	**Implication**	**Factor**
Stem cells have the ability to divide and differentiate into other types of cells so have the potential to treat many diseases (1,2,3)	Cost of research and development Could treat many of the chronic diseases that affect people and enable many of them to be more productive/work and enjoy better health/better quality of life Less cost to NHS for conventional treatments Less expenditure on social care	Economic Economic and social Social Economic
Diseases that could be treated are debilitating and many do not have other treatments available e.g. Alzheimer's. Parkinson's. macular degeneration. diabetes, spinal cord injuries, heart failure, MS (1,2,3)	Alzheimer's is a type of dementia and leads to social isolation and often institutional care needed. Parkinson's is neurodegenerative and leads to lack of ability to work and may also lead to social isolation. Macular degeneration leads to progressive loss of sight and loss of ability to work so need for state assistance. Spinal cord injuries lead to loss of ability to work and loss of quality of life/social isolation and the need for state assistance. SC treatments need to be more effective than the treatments that are currently available.	Economic/social/ethical

	Diabetes affects 9% of people worldwide but in some countries/areas, the rate is higher. Costs the health service a large amount of money and shortens lives. Major cause of death worldwide as risk factor for heart disease and stroke.	
Diabetes (3)	Type 1 is autoimmune disease; usually diagnosed in childhood and requires insulin injections. Can lead to loss of sight and loss of limbs. Type 2 linked to obesity/smoking/alcohol/poor diet and involves genes. Can be prevented or reversed by healthy lifestyle adoptions. Availability of stem cell treatments may prevent people adopting good lifestyles and the factors that have triggered type 2 diabetes will cause other health conditions. Use of stem cells to replace islets of Langerhans will reduce need for injections and blood glucose monitoring and so improve quality of life.	Social/economic Social/economic/ethical
Many of the chronic disease have increased due to increased life expectancy (2)	So more people living to old age and drawing state pension for longer. If healthier would be less of a cost to state/could work for longer/less need to be in care homes/better quality of late life.	Economic, social, ethical
Original source of stem cells was bone marrow transplants (2,3)	First carried out in 1939 but improved in 70s due to donor matching; enabled better treatment for leukaemia, thalassaemia. Increase ability to work/less need for welfare. Need for bone marrow donors. Issues with rejection/immunosuppressant drugs.	Economic, social, ethical

Original stem cells for Parkinson's were embryonic stem cells (3)	These are totipotent (if taken from 1–5 day old embryos) or pluripotent (if taken 6–10 days). This involves destruction of the embryos to which some people object on religious or ethical/moral grounds. However these are spare embryos generated by *in vitro* fertilisation (IVF) treatment and would be destroyed/not allowed to live beyond 14 days).	Ethical
2006, Yamanaka developed induced pluripotent adult stem cells (1,2,3)	He added four transcription factors to switch on genes that had been switched off during cell differentiation. He reprogrammed adult differentiated cells into undifferentiated pluripotent stem cells so able to differentiate into as many cell types and embryonic stem cells but do not have the ethical concerns as embryos not used but could raise issues of possible human cloning.	Ethical
Yamanaka's work has opened up research and clinical trials for stem cell therapy (1,2,3)	Potential to treat many more diseases and hence improve many people's lives and make them economically and socially productive.	Social, ethical, economic
Many clinical trials are underway but most involve small numbers of patients (3)	The trials need to show that the treatments are valid. Are they as or more effective than treatments already available? Are they safe? – stem cells have the ability to keep dividing, as do cancer cells, so there is always a risk of stem cell therapy promoting tumours. To date the trials seem to indicate these treatments are safe but some, e.g. using patient–derived iPSCs for multiple sclerosis, have not been shown to be effective.	Social, ethical
Stem cell therapy seen as a big breakthrough/very significant health intervention so many large companies and venture capitalists are investing. Market accelerating at 36% per year/exponential growth (2,3)	Research is carried out in many universities and by pharmaceutical companies and funding is needed but many are investing as they see a huge potential for returns on their investments. Pharmaceutical companies may charge high prices for patented	Economic

	treatments (to recoup their R and D costs).	
Still areas to be addressed re-regulation, guidelines, standards (1,3)	This is a new treatment so regulatory guidelines have to be developed to address scientific, ethical and legal issues. This will cost money and needs collaboration.	Ethical economic
Research may be duplicated in different research centres	Free sharing of findings between scientists is essential if rapid progress is to be made in SCT; commercial considerations may be a barrier to communication.	Ethical
Research into use of stem cells for heart failure may use ESCs (1)	ESCs can be used in UK only if shown to be the only viable option and after clearance with Human Fertilisation and Embryology Authority. Spare embryos from IVF treatment are donated by couples. These embryos would have been destroyed after 14 days. If this leads to repairing hearts it could reduce the need for donors and transplants and reduce the illegal trade/exploitation of vulnerable people in organ trade. Other sources of SCs are umbilical cord, dental pulp and infant teeth.	Ethical
Good results are seen in the treatment of a type of leukaemia and a type of thalassaemia	SCT can be effective in treating some conditions that have not responded to other approaches.	Social ethical
There is little empirical data evidencing actual progress due to SCT in the treatment of the major (in terms of prevalence) conditions.	The expectations of sufferers, clinicians, administrators and investors may be exaggerated/lead to disappointment.	Ethical social
Fears concerning possible use of iPSCs to clone humans (3)	Cloning of humans is illegal but has been reported to have been carried out in some countries. Strict regulation will be needed. Some investment may lead to less restrictive jurisdictions.	Economic Ethical/social
Private clinics are offering stem cell therapy (2,3)	Many of these clinics are unregulated and offering expensive, untested/not properly trialled treatments that have produced adverse effects. This will also reduce public confidence in stem cell therapy.	Economic Ethical
Environmental	There appear to be no environmental implications – possibly reduce need for organs to be transported by road/plane so fewer emissions.	Environmental

Jobs for scientists and technicians	Creates new job opportunities and demand for appropriate training and qualifications.	Economic Social
Some stem cell therapy work carried out in conjunction with gene editing (3)	Fears by public about 'interfering with nature'.	Ethical
There is/SCT represents a shift towards treatment tailored to the individual, more precisely targeted and producing less side-effects on other tissues and organs	This will require knowledge and understanding of individual genomes, driving a need for advanced technologies capable of rapid and cost-effective analysis of genetic makeup.	Economic

Question 2: *Identify the different organisations and individuals mentioned in the articles and suggest how they may have an influence on the scientific issue. (6 marks)*

Assessment focus	Band 0	Band 1	Band 2	Band 3
Understanding the influence of different organisations / individuals	0	1-2	3-4	5-6
	Level of response not worthy of credit	• Demonstrates adequate knowledge and understanding of how key organisations/ individuals can influence the scientific issue by identifying different types of organisations/individuals. • A basic explanation of how the organisation/individual may have an influence is given but with general statements made and limited linkages to the articles.	• Demonstrates good knowledge and understanding of how key organisations/individuals can influence the scientific issue by identifying different types of organisations/individuals (including any references/ acknowledgments in footnotes) from all three articles. • An explanation of how these organisations/individuals may influence the issue is given which is occasionally supported through linkage and application to the articles.	• Demonstrates comprehensive knowledge and understanding of how key organisations/ individuals can influence the scientific issue by identifying and selecting different types of organisations/individuals (including any references/ acknowledgments in footnotes) from all three articles. • An explanation of how these organisations/individuals may influence the issue is given which is supported throughout with linkage and application to the articles.

Indicative content

Learners:

- **may include other valid suggestions, not listed below, which should be credited**
- **may cover a few examples from the list below**
- **would <u>not</u> be expected to cover all points to get full marks.**

Government and global organisations	
Organisation	**Influence on scientific issue**
NYSTEM1	New York's publicly funded programme to make grants for research into stem cell therapy.
IHME	Institute for health metrics and evaluation – independent global health research centre at University of Washington.
Japanese Government (3)	Development and introduction of regulatory laws.
WHO (3)	World Health Organization. Worldwide specialised UN agency concerned with international public health. Has set up a clinical trials registry of information about all the trials of stem cell therapy that are underway.
Nobel Prize Foundation (2)	Awards prizes to recognise the importance of research and the money enables further research in that field. By rewarding Yamanaka only 6 years after his discovery showed the importance of iPSCs. Raises public profile of the research.
World Economic Forum (2)	International organisation for public-private cooperation to shape global, regional and industry agendas. Raises awareness and may help stimulate investment to fund the research.
FDA (3)	Food and Drug Administration (USA) sets regulatory guidelines.
Human Fertilisation and Embryology Authority (HFEA)	Government regulator to make sure fertility clinics and research centres comply with the law. Its permission has to be given before ESCs to be used.
Non-governmental organisations	
Organisation	
World Economic Forum (1)	International NGO based in Switzerland; committed to improving the state of the world by engaging business, political, academic and other leaders of societies to shape global and regional agendas. Organises international meetings and provides platforms for collaboration on important initiatives in global issues.
Alliance for Regenerative Medicine (1)	International advocacy organisation representing stem cell therapy, gene therapy and regenerative medicine. Updates information and briefs potential stakeholders – investors, academics and patient advocates
Center for Commercialisation of Regenerative Medicine (ISCBRM) (1)	Bridges gap between academia and industry – to enable research (on stem cells) to translate into practice (therapy/treatment).

California Institute for Regenerative Medicine (1)	Starting a repository of iPSCs to give researchers access to many cells.
Ethics committee(s) (2)	Independent panels that review research proposals and have to approve use of ESCs.
Universities and research groups	
Organisation	
Stanford Institute for stem cell biology and regenerative medicine (2)	Prestigious/Ivy league university. Carries out research into developmental biology and use of stem cell therapy for many diseases/regeneration of damaged tissues, such as cartilage that does not heal well.
Harvard Stem Cell Institute (2)	Prestigious/Ivy league university. Many scientists working to harness stem cells for therapy, to improve health care.
Oxford Stem Cell Institute (2)	Research to speed up advances in stem cell therapy and bring new therapies into clinical practice.
Hexagon regenerative medicine fund/Sensulin founded by Mike Moradi (2)	To further regenerative medicine and achieve affordable preventive healthcare for all.
British Heart Foundation (1)	Charity in UK. It funds research to enable scientists in key universities so that they can carry out research into how to regenerate/repair heart tissues after heart attacks and into using stem cells to test new drugs for heart failure/disease. Its funding choices may affect direction taken in research.
Companies	
Organisation	
Celgene (3)	A company that has used placenta-derived multipotent stem cells to treat multiple sclerosis. The treatment was not very effective and it is now planning more randomised controlled trials.
CRISPR, Editas, Intellia (2)	Gene editing companies – could work with stem cells to edit faulty genes so patient-derived iPSCs could be used.
Evercore (2)	Investment bank – is building a regenerative medicine index to help advise investors.
Novartis (2)	Carries out medical research; manufactures and markets a wide range of drugs.
Bluebird bio (2)	Develops gene therapies.
Viacyte (3)	Develops regenerative medicine therapies for diabetes.

Journals and magazines	
Organisation	
BHF magazine (1)	Online publication; provides news about developments in treatments for heart disease to medical professionals and the public.
Stem cell Investigation (3)	Online publication; provides news on developments in stem cell research.

Individuals	
Dolly (the Sheep) (article 1)	First mammal cloned from an adult cell – something previously thought to be impossible. Paved the way for reprogramming cells and inspired Yamanaka to research and develop iPSCs. (John Gurdon's work cloning from adult toad cells in 1962 finally recognised). World's most famous sheep that helped raise awareness of cloning and stem cells – put Roslin Institute on the map and helped Ian Wilmut become head of regenerative medicine at Newcastle Uni; had her own obituary in *Nature* and her body preserved and in Nat Museum of Scotland. She features in GCSE Biology specs so has helped inform people.
Shinya Yamanaka (1, 2 and 3)	Prof at Kyoto University. Director of Centre of iPSC research. Developed iPSCs in 2006 and won Nobel Prize in 2012 (shared with John Gurdon). Has won many other awards.
Nakashima *et al*	Work on spinal cord injuries.
Mike Moradi (2)	Founder of organisation to further regenerative medicine and achieve affordable preventive healthcare for all; authored article 2 which reaches many people/investors.
Dr Paul Knoepfler (2)	Has written a guide to valid sources of stem cells and indicating untrustworthy clinics to be avoided.
Prof Chris Denning (1)	Prof of stem cell biology at University of Nottingham. Now uses iPSCs and can take small piece of skin or blood samples from patients and reprogramme their cells to iPSCs, and then add specific growth factors to make the iPSCs differentiate into various heart cells, so can treat heart failure in less invasive ways.
Prof Michael Schnieder (1)	At Imperial College, is carrying out research into inducing heart cells to regenerate and repair after heart attack; focusing on finding suitable stem cells in heart tissue.
Riham Mohamed Aly (3)	Author of article 3 - an overview of recent research/trials of stem therapy.

Question 3: *Discuss whether Article 3 has made valid judgements. (12 marks)*

Assessment focus	Band 0	Band 1	Band 2	Band 3	Band 4
Interpretation, analysis and evaluation of scientific information	0	1-3	4-6	7-9	10-12
	Level of response not worthy of credit	• Vague statements about the validity of article 3 are made with limited attempt to consider: - how the article has interpreted and analysed the scientific information to support the conclusions/ judgments being made - the validity and reliability of data - references to other sources of information. • The discussion will be unstructured and limited to basic points made.	• The validity of article 3 is discussed which is partially supported by a consideration of: - how the article has interpreted and analysed the scientific information to support the conclusions/ judgments being made - the validity and reliability of data - references to other sources of information. • The discussion shows some structure and coherence.	• The validity of article 3 is discussed which is mostly supported by a consideration of: - how the article has interpreted and analysed the scientific information to support the conclusions/ judgments being made - the validity and reliability of data - references to other sources of information. • The discussion shows a structure which is mostly clear, coherent and logical.	• The validity of article 3 is discussed and is consistently supported throughout the consideration of: - how the article has interpreted and analysed the scientific information to support the conclusions/ judgments being made - the validity and reliability of data - references to other sources of information. • The discussion shows a well-developed structure which is clear, coherent and logical.

Indicative content
Learners should consider how the article has analysed the scientific information to support the conclusions/judgements being made; the validity and reliability of data; references to other sources of information.

Learners:
- **may include other valid suggestions, not listed below, which should be credited**
- **may cover a number of examples from the list below**
- **would not be expected to cover all points to get full marks.**

General:
Learners may comment on the fact that this is published in a recent peer reviewed journal and has many references.
They may also state that the article has drawn on many other articles (a meta-analysis/overview) and that the various pieces of research, also reviewed in many cases all support the conclusions but also highlight any issues.

Conclusions/judgements:
We are moving closer to the reality of using stem cells to treat many diseases
These include
- Leukaemia
- Heart disease/heart failure
- Neurodegenerative disease such as Parkinson's and Alzheimer's
- Treatments for eye disorders such as macular degeneration – cause of sight loss
- Treatments for genetic disorders such as EB
- Treatment for diabetes – which affects 10% of the world's population and is a risks factor for many other conditions
- Treatment for bone and dental disorders such as pulpitis

- Results to date for most conditions do not constitute a breakthrough – except for leukaemia.

In the near future stem cell therapy will significantly improve human health

- A huge amount of research has been carried out over the last ten years, since the advent of iPSCs, so expertise is growing exponentially
- A large amount of clinical trials are underway and many more are awaiting regulatory approval
- Stem cell therapy could reduce the need for donor organs and the problem of rejection, especially if iPSCs are patient-derived
- iPSCs are pluripotent so can differentiate into many types of cell/same potency as an embryo of 6–14 days old (a blastocyst) but without raising issues on ethical grounds
- The significance of Yamanaka's discovery of how adult cells could be induced to become pluripotent
- Reference to the use of transcription factors to switch genes back on
- There is a lack of empirical data to demonstrate progress/no figures to show actual therapeutic success.

There are challenges

- Need to detect and remove incompletely differentiated cells
- Need to look at epigenetic and genomic changes in the stem cells
- Use of stem cells could lead to formation of tumours (as stem cells keep dividing).

Stem cell therapy seems safe but many trials have small numbers of patients.
Spinal cord injury – Japan has approved treatments based on unpublished, results of small trials.
Not all trials have been successful and there may be underreporting of any negative effects.

Validity and reliability:

- Article 3 is a review of research and uses of stem cell therapy
- It reviews lots of research/results of trials by various organisations/research teams
- Most of the trials involve small numbers of patients but show efficacy and safety
- Apart from one trial on MS
- Some trials not yet fully evaluated
- Some ethical issues still to be addressed
- E.g. use of ESCs in some treatments
- Possibility that humans could be cloned from iPSCs
- Article 3 does not refer to unscrupulous private unregulated clinics offering stem cell therapy
- Covers clinical trials worldwide and not just UK or US focused

- It seems highly likely that stem cell therapy will improve human health as many people suffer from chronic and degenerative conditions that at present have limited treatment options, as also indicated in article 2
- Diabetes affects many people and is a risk factor for heart disease, stroke, limb and sight loss and so stem cell therapy to treat it would bring many benefits,

however type 2 diabetes could be reversed by patients adopting healthier lifestyles – but not always easy to implement as healthy diets are more expensive

- An appreciation of the difference between validity (closeness to 'true' situation) and reliability' (consistency in data/repeatability).

References:

- In scientific journal so should have been peer reviewed
- However, peer review process is not always infallible
- Text references given together with list of sources
- Many sources from recent studies (very up to date when article was written)
- Eleven of references are more than ten years old and may be of doubtful relevance
- We do not know of any conflicting evidence as that would not have been included but some areas for further development/challenges have been discussed so shows some balance
- The titles of some papers cited suggest that the author of article 3 used them selectively.

Question 4: *Suggest potential areas for further development and/or research of the scientific issue from the three articles. (5 marks)*

Assessment focus	Band 0	Band 1	Band 2	Band 3
Interprets, analyses and evaluates articles to identify potential areas for further development and/or research	0	1	2-3	4-5
	Level of response not worthy of credit	• Areas for further development and/or research of the scientific issue are identified but these are usually vague descriptions with limited analysis/evaluation of the articles to support the statements being made.	• A description for further areas of development and/or research of the scientific issue is given. • Provides occasional evidence from the analysis/evaluation of the articles and attempts to synthesise and integrate relevant knowledge.	• A description for further areas of development and/or research of the scientific issue is given. • Consistently provides evidence from the analysis/evaluation of the articles and demonstrates throughout the skills of synthesising and integrating relevant knowledge.

Indicative content

Learners:

- **may include other valid suggestions, not listed below, which should be credited**
- **may cover a number of examples from the list below**
- **would not be expected to cover all points to get full marks.**

Further research needed on:

- More clinical trials needed
- With larger patient numbers/participants
- Gender balance with participants
- With different types of stem cells
- Trials need to be fully evaluated
- Need to be certain there is no risk of cancer
- Need for screening to eliminate any not fully differentiated cells
- Need to set up banks of stem cells for researchers to use
- Need to establish way of storing patient-derived stem cells
- Develop use of stem cells to screen effects of possible/novel drug treatments
- Optimal conditions for storage and maintenance of a range of iPSC and MSC.

Issue specific research:

- More trials needed to address concerns raised in trials using stem cells for MS as there were some complications
- More trials needed for spinal cord injuries – early trials have shown some regeneration of neurone axons and increased connectivity (dendrites)
- Heart and circulatory disease kills 1 in 4 people so more research in use of stem cell therapy to treat that and improve people's lives
- More trials on treatment of macular degeneration as, to date, very small trials
- More research/trials needed on use of encapsulated stem cells placed under skin
- More studies needed on what happens after transplantation of stem cells for pulpitis/teeth and jawbones
- Assess the efficacy and safety.

Wider research:

- Widen the debate on use of ESCs as these are all taken from spare embryos from IVF programmes that would be destroyed anyway
- More information/raising public awareness
- Increase teaching about stem cell therapy in schools
- Development of more novel stem cell therapies for various forms of cancer
- Better regulation of private clinics/informing public to beware of using such establishments
- Improve the sharing of research findings between teams/do not allow commercial issues to inhibit the exchange of ideas.
- Regulate to prevent the vulnerable from being persuaded to fund questionable or fruitless research.

Credit other valid suggestions:

- e.g. regulation of clinics
- establishing repositories for stem cells
- need for continued funding of pure/curiosity driven research.

Question 5: *You are a trainee technician working in a laboratory. The scientists in the laboratory are carrying out research into using stem cell therapy. You have been asked to write an article for a youth science magazine about the benefits and possible risks of stem cell therapy. Teenagers interested in stem cell therapy will read the article. (15 marks)*

Assessment focus	Band 0	Band 1	Band 2	Band 3	Band 4
Synthesises content ideas and demonstrates an understanding of scientific reporting and its relationship with reporting medium and target audience	0	1-4	5-8	9-12	13-15
	Level of response not worthy of credit	• Identifies some of the main points and evidence from the three articles with limited attempt to summarise these.	• Summarises the main points and evidence including any supporting and conflicting statements from the three articles.	• Summarises and attempts to synthesise the main points and evidence including any supporting and conflicting statements from the three articles.	• Summarises and synthesises the main points and evidence including any supporting and conflicting statements consistently from the three articles.
		• Shows little awareness of audience or purpose.	• Shows an awareness of audience and purpose.	• Selects material to suit audience and purpose, with appropriate use of tone, style and scientific terminology.	• Consistently selects and organises material for particular effect, with effective use of tone, style and scientific terminology.
		• The article will be unstructured and limited to basic points made.	• The article shows some structure and coherence.	• The article shows a structure which is mostly clear, coherent and logical.	• The article shows a well-developed structure which is clear, coherent and logical.

Indicative content

Learners:

- **may include other valid suggestions, not listed below, which should be credited**
- **may cover a number of examples from the list below**
- **would not be expected to cover all points to get full marks**
- **may present information in tables and/or using bullet points and/or diagrams.**

Tone and style show awareness of audience:

- Audience will be teenagers with limited knowledge of science
- Report needs to be structured so that it is easy to read
- May use diagrams, tables bullet points and side headings
- Scientific terms need to be explained.

Indicative content:

- Explains what stem cells are – brief history
- Explains different types of stem cells especially iPSCs and their significance – refs to Shinyo Yamanaka
- Explains how they may be used – some examples – could be in a table
- Summarises advantages and disadvantages
- Advantages e.g. treat conditions that are currently untreatable, improve quality of life, testing drugs for treatment, iPSCs can be taken from patient therefore no rejection problems
- SCT is likely to be a growth area for employment of scientists and of laboratory (and) technical staff
- Potential to treat major health conditions of 21st century (i.e. ....); potential positive impact on the economics of health and social care; potential to accelerate assessment of new drugs, to reduce use of animals in drug testing
- Possible risks e.g. could cause tumours/cancers, untrustworthy clinics/vulnerable may be given false hope/induced to invest in unaccredited clinics/clinical trials
- Covers ethical concerns – pros and cons of using ESCs, approval needed

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